

Claims

- [c1] A composition comprising a hydrogel formed by a mixture of two or more of (1) a non-acidic poly(N-vinyl lactam) with a K value of at least 30 (2) a water soluble multifunctional amine-containing polymer and mixtures thereof or (3) a chitosan derivative or mixtures thereof.
- [c2] The composition of Claim 1 wherein the non-acidic poly(N-vinyl lactam) is selected from the group consisting of homopolymers, copolymers and terpolymers of N-vinyl lactam.
- [c3] The composition of Claim 2 wherein the copolymers and terpolymers of poly(N-vinyl lactam) are selected from the group consisting of N-vinyl lactam monomer copolymerized with monomers containing a vinyl functional group.
- [c4] The composition of Claim 3 wherein the vinyl containing monomers are selected from the group consisting of acrylates, hydroxyalkylacrylates, methacrylates, acrylic acid, methacrylic acid and acrylamides.
- [c5] The compositions of Claim 4 wherein the vinyl containing monomers are selected from the group consisting of vinylpyrrolidone, vinylcaprolactam, dimethylaminoethyl

methacrylate terpolymers.

- [c6] The composition of Claim 2 wherein a homopolymer of the non-acidic poly(N-vinyl lactam) is vinylpyrrolidone.
- [c7] The composition of Claim 1 wherein the multifunctional amine-containing polymer is selected from the group consisting of polyethyleneimine, amine terminated polyethylene oxide polymers, amine terminated polyethylene/polypropylene oxide polymers, polymers and copolymers of dimethyl amino ethyl methacrylate, and vinyl pyrrolidone.
- [c8] The composition of Claim 1 wherein the chitosan derivative is a biocompatible salt.
- [c9] The composition of Claim 8 wherein the chitosan salt is selected from the group consisting of chitosan reacted with a reactant selected from the group consisting of pyrrolidone carboxylic acid, glutamic acid and an acetate.
- [c10] The composition of Claim 1 wherein the chitosan is selected from the group consisting of N,O-carboxymethyl chitosan, and N,O-carboxybutyl chitosan.
- [c11] The composition of Claim 1 further including biologically active and pharmaceutically acceptable substances hav-

ing curative or therapeutic value.

- [c12] The composition of Claim 11 wherein the active materials are selected from the group consisting of hypnotics, sedatives, tranquilizers, anti-convulsants, muscle relaxants, analgesics, antipyretic agents, anti-inflammatory agents, local anesthetics, antispasmodics, anti-ulcer agents, anti-virals, anti-bacterials, anti-fungals, sympathomimetic agents, cardiovascular agents and antitumor agents.
- [c13] The composition of Claim 12 wherein said active materials are selected from the group consisting of nitroglycerine, scopolamine, pilocarpine, ergotamine tartrate, phenylpropanolamine, theophylline, antimicrobials tetracycline, neomycin, oxytetracycline, triclosan, sodium cefazolin, silver sulfadiazine, methylsalicylate, salicylic acid, nicotines, methyl nicotinate, chlorhexidine gluconate, menthol, capsaicin, lidocaine and benzocaine.
- [c14] The composition of Claim 1 further including an electrolyte whereby said gel is rendered electrically conductive.
- [c15] The composition of Claim 14 wherein said electrolyte is selected from the group consisting of sodium chloride, potassium chloride and magnesium acetate.

- [c16] The composition of Claim 1 further including a skin-hydrating agent.
- [c17] The composition of Claim 16 wherein said skin-hydrating agent is selected from the group consisting of water, sodium pyrrolidone carboxylate, lactic acid, hyaluronic acid and hydrolyzed collagen.
- [c18] The composition of Claim 1 further including enhancing agents selected from the group consisting of wetting agents, moisturizers, plasticizers, surfactants and dispersing agents.
- [c19] The composition of Claim 18 where said agents are selected from the group consisting of glycerin, propylene glycol and polyethylene glycol.
- [c20] The composition of Claim 1 further including an electrolytic salt as an anti-osmotic agent.
- [c21] The composition of Claim 20 wherein said agent is selected from the group consisting of an alkali metal chloride and sodium bicarbonate.
- [c22] The composition of Claim 1 further including additives selected from the group consisting of polymer lattices, fillers, surfactants, pigments, dyes and fragrances.

[c23] (EXAMPLE 6) The composition of Claim 1 formed by combining (a) an aqueous solution comprising non-acidic polyvinylpyrrolidone and glycerin in a weight ratio of about 1.5 to 1 with (b) an aqueous solution comprising carboxymethyl chitosan, glycerin and polyethyleneimine in a weight ratio, respectively, of about 6.6 to 156 to 1 wherein the total weight of aqueous solutions (a) and (b) are in the range of about 1 to 1.

[c24] A composition comprising a hydrogel formed by a mixture of a non-acidic poly(N-vinyl lactam) with a K value of at least 30 at and a water soluble multifunctional amine-containing polymer.

[c25] The composition of Claim 24 wherein the poly(N-vinyl lactam) is selected from the group consisting of homopolymers, copolymers and terpolymers of N-vinyl lactam.

[c26] The composition of Claim 25 the copolymers and terpolymers of poly(N-vinyl lactam) are selected from the group consisting of N-vinyl lactam monomer copolymerized with monomers containing a vinyl functional group.

[c27] The composition of Claim 26 wherein the vinyl containing monomers are selected from the group consisting of acrylates, hydroxyalkylacrylates, methacrylates, acrylic

acid, methacrylic acid and acrylamides.

- [c28] The composition of Claim 24 wherein a homopolymer of the non-acidic poly(N-vinyl lactam) is vinylpyrrolidone.
- [c29] The composition of Claim 25 wherein the weight ratio of polyvinylpyrrolidone to multifunctional amine-containing polymer is in the range of from about 2/1 to about 80/1.
- [c30] The composition of Claim 24 wherein the multifunctional amine-containing polymer is selected from the group consisting of polyethyleneimine, amine terminated polyethylene oxide polymers, amine terminated polyethylene/polypropylene oxide polymers, polymers and copolymers of dimethyl amino ethyl methacrylate, and vinyl pyrrolidone.
- [c31] The composition of Claim 24 further including biologically active and pharmaceutically acceptable substances having curative or therapeutic value.
- [c32] The composition of Claim 24 wherein the active materials are selected from the group consisting of hypnotics, sedatives, tranquilizers, anti-convulsants, muscle relaxants, analgesics, antipyretic agents, anti-inflammatory agents, local anesthetics, antispasmodics, anti-ulcer agents, anti-virals, anti-bacterials, anti-fungals, sympathomimetic agents, cardiovascular agents and antitumor

agents.

- [c33] The composition of Claim 32 wherein said active materials are selected from the group consisting of nitroglycerine, scopolamine, pilocarpine, ergotamine tartrate, phenylpropanolamine, theophylline, antimicrobials tetracycline, neomycin, oxytetracycline, triclosan, sodium cefazolin, silver sulfadiazine, methylsalicylate, salicylic acid, nicotines, methyl nicotinate, chlorhexidine gluconate, menthol, capsaicin, lidocaine and benzocaine.
- [c34] The composition of Claim 24 further including an electrolyte whereby said gel is rendered electrically conductive.
- [c35] The composition of Claim 34 wherein said electrolyte is selected from the group consisting of sodium chloride, potassium chloride and magnesium acetate.
- [c36] The composition of Claim 24 further including a skin-hydrating agent.
- [c37] The composition of Claim 36 wherein said skin-hydrating agent is selected from the group consisting of water, sodium pyrrolidone carboxylate, lactic acid, hyaluronic acid and hydrolyzed collagen.
- [c38] The composition of Claim 24 further including enhancing

agents selected from the group consisting of wetting agents, moisturizers, plasticizers, surfactants and dispersing agents.

- [c39] The composition of Claim 38 where said agents are selected from the group consisting of glycerin, propylene glycol and polyethylene glycol.
- [c40] The composition of Claim 24 further including an electrolytic salt as an anti-osmotic agent.
- [c41] The composition of Claim 40 wherein said agent is selected from the group consisting of an alkali metal chloride and sodium bicarbonate.
- [c42] The composition of Claim 24 further including additives selected from the group consisting of polymer lattices, fillers, surfactants, pigments, dyes and fragrances.
- [c43] A composition comprising a non-acidic poly(N-vinyl lactam) with a K value of at least 30 and a multifunctional amine-containing polymer in a weight ratio of about 8.75 to 1.
- [c44] (EXAMPLE 8) A composition formed by combining (a) an aqueous solution comprising non-acidic polyvinylpyrrolidone, lidocaine hydrogen chloride and glutaric dialdehyde in a weight ratio, respectively, of

about 69.7 to 12 to 1 with (b) an aqueous solution comprising polyethyleneimine, glycerin and polyvinylpyrrolidone/dimethylaminoethyl-methacrylate copolymer in a weight ratio, respectively, of about 1.87 to 1.25 to 1 wherein the total weight of aqueous solution of each of (a) and (b) are in the range of about 0.9 to 1 respectively.

[c45] (EXAMPLE 7) A composition formed by combining (a) an aqueous solution comprising non-acidic polyvinylpyrrolidone, lidocaine hydrogen chloride and glutaric dialdehyde in a weight ratio, respectively, of about 68.2 to 16 to 1 with (b) an aqueous solution of comprising polyethyleneimine, glycerin and polyvinylpyrrolidone/dimethylaminoethyl-methacrylate copolymer in a weight ratio, respectively, of about 1.85 to 1.25 to 1 wherein the total weight of the aqueous solution in each of (a) and (b) are in the range of about 1 to 1 respectively.

[c46] (EXAMPLE 9) A composition formed by combining (a) an aqueous solution comprising non-acidic polyvinylpyrrolidone, polyethylene glycol, benzocaine and glutaric dialdehyde in a weight ratio respectively of about 56 to 34 to 14 to 1 with (b) an aqueous solution comprising polyethylene glycol, glycerin, benzocaine, polyvinylpyrrolidone/dimethylaminoethyl-methacrylate copolymer and polyethyleneimine in the weight ratio re-

spectively of about 5.5 to 2.5 to 2.5 to 2 to 1 wherein the total weight of each aqueous solution (a) and (b) is in the range of about 1 to 1.

- [c47] A composition comprising a hydrogel formed by a mixture of a non-acidic poly(N-vinyl lactam) with a K value of at least 30 and a chitosan derivative or mixtures thereof..
- [c48] The composition of Claim 47 wherein the non-acidic poly(N-vinyl lactam) is selected from the group consisting of homopolymers, copolymers and terpolymers of N-vinyl lactam.
- [c49] The composition of Claim 48 wherein the copolymers and terpolymers of poly(N-vinyl lactam) are selected from the group consisting of N-vinyl lactam monomer copolymerized with monomers containing a vinyl functional group.
- [c50] The composition of Claim 49 wherein the copolymers and terpolymers of poly(N-vinyl lactam) are selected from the group consisting of N-vinyl lactam monomer copolymerized with monomers containing a vinyl functional group.
- [c51] The composition of Claim 50 wherein the vinyl containing monomers are selected from the group consisting of

vinylpyrrolidone, vinylcaprolactam, dimethylaminoethyl methacrylate terpolymers.

- [c52] The composition of Claim 48 wherein a homopolymer of the non-acidic poly(N-vinyl lactam) is vinylpyrrolidone.
- [c53] The composition of Claim 47 wherein the chitosan derivative is a biocompatible salt.
- [c54] The composition of Claim 53 wherein the chitosan salt is selected from the group consisting of chitosan reacted with a reactant selected from the group consisting of pyrrolidone carboxylic acid, glutamic acid and an acetate.
- [c55] The composition of Claim 1 wherein the chitosan is selected from the group consisting of N,O-carboxymethyl chitosan, and N,O-carboxybutyl chitosan.
- [c56] The composition of Claim 55 further including biologically active and pharmaceutically acceptable substances having curative or therapeutic value.
- [c57] The composition of Claim 56 wherein the active materials are selected from the group consisting of hypnotics, sedatives, tranquilizers, anti-convulsants, muscle relaxants, analgesics, antipyretic agents, anti-inflammatory agents, local anesthetics, antispasmodics, anti-ulcer

agents, anti-virals, anti-bacterials, anti-fungals, sympathomimetic agents, cardiovascular agents and antitumor agents.

- [c58] The composition of Claim 57 wherein said active materials are selected from the group consisting of nitroglycerine, scopolamine, pilocarpine, ergotamine tartrate, phenylpropanolamine, theophylline, antimicrobials tetracycline, neomycin, oxytetracycline, triclosan, sodium cefazolin, silver sulfadiazine, methylsalicylate, salicylic acid, nicotines, methyl nicotinate, chlorhexidine gluconate, menthol, capsaicin and benzocaine.
- [c59] The composition of Claim 47 further including an electrolyte whereby said gel is rendered electrically conductive.
- [c60] The composition of Claim 59 wherein said electrolyte is selected from the group consisting of sodium chloride, potassium chloride and magnesium acetate.
- [c61] The composition of Claim 47 further including a skin-hydrating agent.
- [c62] The composition of Claim 61 wherein said skin-hydrating agent is selected from the group consisting of water, sodium pyrrolidone carboxylate, lactic acid, hyaluronic acid and hydrolyzed collagen.

- [c63] The composition of Claim 47 further including enhancing agents selected from the group consisting of wetting agents, moisturizers, plactisizers, surfactants and dispersing agents.
- [c64] The composition of Claim 63 where said agents are selected from the group consisting of glycerin, propylene glycol and polyethylene glycol.
- [c65] The composition of Claim 47 further including an electrolytic salt as an anti-osmotic agent.
- [c66] The composition of Claim 65 wherein said agent is selected from the group consisting of an alkali metal chloride and sodium bicarbonate.
- [c67] The composition of Claim 47 further including additives selected from the group consisting of polymer lattices, fillers, surfactants, pigments, dyes and fragrances.
- [c68] The composition of Claim 47 wherein the weight ratio of the poly(N-vinyl lactam) to chitosan derivative is in the range of from about 2/1 to about 100/1.
- [c69] The composition of Claim 47 wherein comprising, by weight, from about 1 percent to about 30 percent of a pharmaceutically acceptable local anesthetic, from about 0 percent to about 50 percent of a moisturizer, from

about 0 percent to about 50 percent of a plasticizer, from about 0 percent to about 4 percent by weight of a preservative and wherein the weight ratio of poly(N-vinyl lactam) to chitosan derivative is in the range of from about 80/1 to about 2/1.

- [c70] (EXAMPLE 2) A composition of Claim 47 wherein the poly(N-vinyl lactam) is polyvinylpyrrolidone and the weight ratio of polyvinylpyrrolidone to chitosan derivative is in the range of about 17.5/1.
- [c71] A composition comprising a hydrogel formed by the mixture of a water soluble multifunctional amine-containing polymer and a chitosan derivative or mixtures thereof.
- [c72] The composition of Claim 71 wherein the multifunctional amine-containing polymer is selected from the group consisting of polyethyleneimine, amine terminated polyethylene oxide polymers, amine terminated polyethylene/polypropylene oxide polymers, polymers and copolymers of dimethyl amino ethyl methacrylate, and vinyl pyrrolidone.
- [c73] The composition of Claim 71 wherein the chitosan derivative is a biocompatible salt.
- [c74] The composition of Claim 73 wherein the chitosan salt is

selected from the group consisting of chitosan reacted with a reactant selected from the group consisting of pyrrolidone carboxylic acid, glutamic acid and an acetate.

- [c75] The composition of Claim 72 wherein the chitosan is selected from the group consisting of N,O-carboxymethyl chitosan, and N,O-carboxybutyl chitosan.
- [c76] The composition of Claim 72 further including biologically active and pharmaceutically acceptable substances having curative or therapeutic value.
- [c77] The composition of Claim 76 wherein the active materials are selected from the group consisting of hypnotics, sedatives, tranquilizers, anti-convulsants, muscle relaxants, analgesics, antipyretic agents, anti-inflammatory agents, local anesthetics, antispasmodics, anti-ulcer agents, anti-virals, anti-bacterials, anti-fungals, sympathomimetic agents, cardiovascular agents and antitumor agents.
- [c78] The composition of Claim 77 wherein said active materials are selected from the group consisting of nitroglycerine, scopolamine, pilocarpine, ergotamine tartrate, phenylpropanolamine, theophylline, antimicrobials tetracycline, neomycin, oxytetracycline, triclosan, sodium ce-

fazolin, silver sulfadiazine, methylsalicylate, salicylic acid, nicotinate, methyl nicotinate, chlorhexidine gluconate, menthol, capsicum and benzocaine.

- [c79] The composition of Claim 71 further including an electrolyte whereby said gel is rendered electrically conductive.
- [c80] The composition of Claim 79 wherein said electrolyte is selected from the group consisting of sodium chloride, potassium chloride and magnesium acetate.
- [c81] The composition of Claim 72 further including a skin-hydrating agent.
- [c82] The composition of Claim 81 wherein said skin-hydrating agent is selected from the group consisting of water, sodium pyrrolidone carboxylate, lactic acid, hyaluronic acid and hydrolyzed collagen.
- [c83] The composition of Claim 72 further including enhancing agents selected from the group consisting of wetting agents, moisturizers, plasticizers, surfactants and dispersing agents.
- [c84] The composition of Claim 83 where said agents are selected from the group consisting of glycerin, propylene glycol and polyethylene glycol.

- [c85] The composition of Claim 72 further including an electrolytic salt as an anti-osmotic agent.
- [c86] The composition of Claim 85 wherein said agent is selected from the group consisting of an alkali metal chloride and sodium bicarbonate.
- [c87] The composition of Claim 72 further including additives selected from the group consisting of polymer lattices, fillers, surfactants, pigments, dyes and fragrances.
- [c88] The composition of Claim 72 wherein the weight ratio of water soluble multifunctional amine-containing polymer and a chitosan derivative is in the range of 50/1 to 1/50.
- [c89] (EXAMPLE 3)A composition of Claim 72 wherein the water soluble multifunctional amine-containing polymer is polyethyleneimine and the chitosan derivative is carboxymethyl chitosan and wherein the weight ratio of said amine to said chitosan derivative is about 1.2 to 1.
- [c90] (EXAMPLE 4)A composition of Claim 72 wherein the water soluble multifunctional amine-containing polymer is polyethyleneimine and the chitosan derivative is carboxymethyl chitosan and wherein the weight ratio of said amine to said chitosan derivative is about 0.3 to 1 and further including about 13 percent by weight glycerin.

- [c91] (EXAMPLE 5) A composition of Claim 72 wherein the water soluble multifunctional amine-containing polymer is polyethyleneimine and the chitosan derivative is carboxymethyl chitosan and wherein the weight ratio of said amine to said chitosan derivative is about 0.15 to 1 and further including about 47 percent by weight glycerin.
- [c92] The method of treating a dental dry socket which comprises applying to said socket a layer of the composition of Claim 12.
- [c93] The method of treating a dental dry socket which comprises applying to said socket a layer of the composition of Claim 32.
- [c94] The method of treating a dental dry socket which comprises applying to said socket a layer of the composition of Claim 44.
- [c95] The method of treating a dental dry socket which comprises applying to said socket a layer of the composition of Claim 45.
- [c96] The method of treating a dental dry socket which comprises applying to said socket a layer of the composition of Claim 46.
- [c97] The method of treating a dental dry socket which com-

prises applying to said socket a layer of the composition of Claim 58.

[c98] The method of treating a dental dry socket which comprises applying to said socket a layer of the composition of Claim 78.

[c99] A dental anesthetic application comprising a composition of claim 24 further including an anesthetic selected from the group comprising lidocaine, benzocaine and Eugenol in an amount of from about 1 percent to about 30 percent by weight, moisturizers and plasticizers in the range of from about 0 percent to 50 percent by weight and preservatives in the range of from about 0 percent to about 4 percent by weight and wherein the weight ratio of non-acidic poly(N-vinyl lactam) to multifunctional amine-containing polymer is in the range of from about 80/1 to about 2/1.

[c100] A dental anesthetic application comprising a composition of claim 24 further including an anesthetic selected from the group comprising lidocaine, benzocaine and Eugenol in an amount of from about 2 percent to about 20 percent by weight, moisturizers and plasticizers in the range of from about 5 percent to 25 percent by weight and preservatives in the range of from about 0.01 percent to about 2 percent by weight and wherein the weight ratio

of non-acidic poly(N-vinyl lactam) to multifunctional amine-containing polymer is in the range of from about 30/1 to about 5/1.

[c101] A dental anesthetic application comprising a composition of claim 70.

[c102] A dental anesthetic of Claim 101 wherein the local anesthetic is selected from the group consisting of lidocaine, benzocaine and Eugenol.

[c103] A dental anesthetic application comprising a composition of Claim 78.

[c104] A cosmetic face mask comprising a gel of Claim 1.

[c105] A cosmetic face mask comprising a gel of Claim 16.

[c106] A cosmetic face mask comprising a gel of Claim 17.

[c107] A kit for a cosmetic gel comprising separate portions of a non-acidic poly(N-vinyl lactam) having a K value of at least 30 and a multifunctional amine-containing polymer selected from the group consisting of a multifunctional amine-containing polymer and a chitosan derivative and a separate portion containing cosmetic agents selected from the group consisting of hydrating agents, fragrances and skin nutrients with instructions as to the order of addition to and the amount of water in which to

form a hydrogel, application and removal directions.

[c108] A hydrogel in sheet or roll form comprising a composition of Claim 1 further including a releasable backing sheet.

[c109] The hydrogel of Claim 108 wherein the releasable backing layer provides protection of the hydrogel from gases, liquid, air and the selection of area to be treated.